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| 10/587,676 | 07/27/2006 | Harry Vig | 022A-03US1 | 8464 |

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| EXAMINER |
|---|
| ANDERSON, MICHAEL D |

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| | Application No. | Applicant(s) |
|---|---|---|
| | 10/587,676 | VIG, HARRY |
| **Office Action Summary** | Examiner | Art Unit | |
| | MICHAEL ANDERSON | 2433 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS,
WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on <u>27 July 2006</u>.

2a)☐ This action is **FINAL**.  2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) <u>1-13</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) <u>1-13</u> is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on <u>27 July 2006</u> is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All  b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage
      application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☒ Information Disclosure Statement(s) (PTO/SB/08)
    Paper No(s)/Mail Date <u>07/27/2006</u>.

4)☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application

6)☐ Other: _____.

## DETAILED ACTION

### *Information Disclosure Statement*

1.      The information disclosure statement (IDS) submitted on 07/27/2006 was

filed after the mailing date. The submission is in compliance with the provisions

of 37 CFR 1.97.  Accordingly, the information disclosure statement is being

considered by the examiner.

### *Claim Rejections - 35 USC § 101*

2.      35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or
> composition of matter, or any new and useful improvement thereof, may obtain a patent
> therefor, subject to the conditions and requirements of this title.

**Claim 1 and all intervening claims (2-8)**, are rejected under 35 U.S.C.

101 as not falling within one of the four statutory categories of invention.  While

the claims recite a series of steps or acts to be performed, a statutory "process"

under 35 U.S.C. 101 must (1) be tied to particular machine, or (2) transform

underlying subject matter (such as an article or material) to a different state or

thing. See page 10 of In Re Bilski 88 USPQ2d 1385. The instant claims are

neither positively tied to a particular machine that accomplishes the claimed

method steps nor transform underlying subject matter, and therefore do not

qualify as a statutory process. The method including steps of establishing timing

for first and second modulators, setting the second modulator to a fixed

modulation, and incremental scanning an activation signal over a range of timing

values is broad enough that the claim could be completely performed mentally, verbally or without a machine nor is any transformation apparent. For example a person could establish timing, set a modulator to a fixed value of modulation, and scan an activation signal which would allow data to be processed in respect to the person's needs.

   **Claim 9 and intervening claim 10** are rejected under 35 U.S.C. 101 as not falling within one of the four statutory categories of invention. While the claims recite a series of steps or acts to be performed, a statutory "process" under 35 U.S.C. 101 must (1) be tied to particular machine, or (2) transform underlying subject matter (such as an article or material) to a different state or thing. See page 10 of In Re Bilski 88 USPQ2d 1385. The instant claims are neither positively tied to a particular machine that accomplishes the claimed method steps nor transform underlying subject matter, and therefore do not qualify as a statutory process. The method including steps of establishing timing between two modulators, exchanging non-quantum signals, performing course timing adjustment and performing a fine timing adjustment is broad enough that the claim could be completely performed mentally, verbally or without a machine nor is any transformation apparent. For example a person could establish timing between two modulators, exchange non-quantum signals, perform course timing adjustment and perform a fine timing adjustment which would allow data to be processed in respect to the person's needs.

   **Claim 11 and all intervening claims (12-13)** are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject

matter. The claims are directed to software per se, which does not fall into the

categories of "process", "machine", "manufacture" and "composition of matter".

Referring to claim 11, claim 11 recites the limitation, " establishing timing

between first and second modulator signals, setting the second modulator to

fixed modulation, setting first activation signal too a large width, and varying first

activation signal", which directs the claim to software per se.

3.                      ***Claim Rejections - 35 USC § 103***

        The following is a quotation of 35 U.S.C. 103(a) which forms the basis for

all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described
> as set forth in section 102 of this title, if the differences between the subject matter sought to
> be patented and the prior art are such that the subject matter as a whole would have been
> obvious at the time the invention was made to a person having ordinary skill in the art to which
> said subject matter pertains. Patentability shall not be negatived by the manner in which the
> invention was made.

        Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable

over Patent No.: US 7,606,371 B2 to Zavriyev et al (hereafter referenced as

Zavriyev) in view of Patent Number: 5,515,438 to Bennett et al (hereafter

referenced as Bennett).

Regarding **claim 1**, Zavriyev discloses "A method of establishing timing for first

and second modulators in a quantum key distribution (QKD) system"*(see phase*

*modules [Fig.1/items 104A and 104B] also see phase modulators PMB1 and*

*timed gating pulse GPB1 [Col.7/lines 1-10])*, "comprising: setting the second

modulator to a fixed modulation"*(a fixed relationship/modulation is*

*maintained between modulated signals [abstract])*; "setting the first modulator

to a fixed modulation" *(a fixed relationship/modulation is maintained between*

*modulated signals [abstract]),* Zavriyev does not explicitly disclose

"incrementally scanning an activation signal for the first modulator over a range

of timing values to determine the first modulator activation signal timing based on

a change in detector counts of exchanged non-quantum signals; and

incrementally scanning an activation signal for the second modulator over a

range of timing values to determine the second modulator activation signal timing

based on a change in detector counts of exchanged non-quantum signals."

However, Bennett in an analogous art discloses a non-orthogonal quantum key

distribution method which uses a beam splitter to split off a small fraction of the

modulated signal for minor measurement where the major measurement is

performed by detecting two pulses S and R in two separate square -law

detectors and recording the result of component intensity, integrated over the

pulse duration *(Bennett [Col.6/ lines4-20] also see Bennett [Fig.1]).*

Therefore, it would have been obvious to one of ordinary skill in the art at

the time the invention was made to modify Zavriyev's two-way Quantum Key

Distribution system and active compensation with a non-orthogonal quantum key

distribution method which uses a beam splitter to split off a small fraction of the

modulated signal for minor measurement where the major measurement is

performed by detecting two pulses S and R in two separate square -law

detectors and recording the result of component intensity , integrated over the

pulse duration as suggested by Bennett *(Bennett[Col.6/ lines4-20] also see*

*Bennet[Fig.1]).*

Regarding **claim 2** in view of claim 1, the references combined disclose

"wherein the QKD system is a two-way system" *(two-way actively stabilized*

*QKD system Zavriyev [abstract]), "and the first and second modulators are*

phase modulators" *(Alice phase modulator Zavriyev [see Fig.1/PMA] and Bob*

*phase modulator Zavriyev [See Fig.1/PMB1).*

Regarding **claim 3** in view of claim 2, the references combined disclose

"wherein the first modulator is in a first QKD station (Bob) that generates the non-

quantum signals, the second modulator is in a reflective QKD station (Alice) that

reflects the non-quantum signals back to the first QKD station"*(Alice phase*

*modulator Zavriyev[see Fig.1/PMA] and Bob phase modulator Zavriyev[See*

*Fig.1/PMB1),* "and wherein the method further includes: discerning between two

timing intervals associated with non-quantum signals entering and leaving the

first QKD station to ensure that only non-quantum or quantum signals entering

the first QKD station are modulated by the first modulator"*( Zavriyev[Fig.4]*

*discloses timing of quantum signal(QSI) and control signal(CS)*

*Zavriyev[Col.3/line42-45]).*

Regarding **claim 4** in view of claim 1, the references combined disclose

"wherein the activation signals for the first and second modulators provide

respective modulations that result in a maximum change in detector counts when

the exchanged transmitted non-quantum signals experience a change in

modulation"*(Zavriyev[Fig.5/item 112] discloses the detection stage for the*

*first and second signals of first and second modulators*

*Zavriyev[Col.7/line54-63], non quantum signal or the control signal follows*

*the same path as the quantum signal during the detection stage*

*Zavriyev[Col.7/line 14-22]),*

Regarding **claim 5** in view of claim 1, the references combined disclose

"wherein the activation signals for the first and second modulators provide

respective modulations that are not basis modulations associated with

establishing a quantum key", *i.e. activation signals provide modulation not*

*associated with the quantum signal(the control signal follows the same*

*path as the quantum signal and is modulated and divided into two signals*

*in the same manner as the quantum signal during the detection stage*

*Zavriyev[Col.7/line 19-23]),*

Regarding **claim 6** in view of claim 1, the references combined disclose

"wherein the detector counts occur in first and second detectors, which are

arranged so that constructively interfered non-quantum signals are detected in

the first detector and destructively interfered non-quantum signals are detected in

the second detector" *(Zavriyev[Fig.5/item 112] discloses the detection stage*

*for the first and second signals of first and second modulators*

*Zavriyev[Col.7/line54-63], non quantum signal or the control signal follows*

*the same path as the quantum signal during the detection stage*

*Zavriyev[Col.7/line 14-22]),*

Regarding **claim 7** in view of claim 1, the references combined disclose

"including for each modulator: establishing a coarse timing interval"

*(Zavriyev[Fig.3a-3b] disclose I vs. time intervals also see*

*Zavriyev[Col.3/lines38-41])*; "dividing up the coarse timing interval into a

number of sub-intervals", *i.e. timing signal is split into multiple signals( see*

*gating pulses GPA and GPB (Zavriyev[Col.8/lines25-32])*; "and

incrementally scanning the sub-intervals to establish a more accurate

modulator timing"*(central interference pulse can be detected from quantum*

*signal Zavriyev[Col.8/line25-32]).*

Regarding **claim 8** in view of claim 7, the references combined disclose

"including reducing a width of the activation signal for each modulator" *(Variable*

*attenuator can attenuate the signals Zavriyev [Col.5/line16-22] also see*

*Fig.2A).*

Regarding **claim 9,** Zavriyev discloses "A method of establishing timing

between two modulators in a quantum key distribution (QKD) system by

exchanging non-quantum signals", *i.e. establishing timing  within two*

*modulators by exchanging signals prior to quantum modulation (non*

*quantum signals are maintained within the control channel signal and*

*gating signal also see timing diagram [Col.7/ lines 43-51] also see [Fig.4]),*

"the method comprising for each modulator:  exchanging non-quantum signals

that pass through each modulator"*(Alice phase modulator Zavriyev[see*

*Fig.1/PMA] and Bob phase modulator Zavriyev[See Fig.1/PMB1)*; Zavriyev

does not explicitly disclose "performing a coarse timing adjustment by

incrementally scanning a relatively wide modulator activation signal over a range

of possible modulator timings to establish a coarse timing value that corresponds

to a change in an amount of non-quantum signals detected due to a change in modulation of the non-quantum signal; and performing a fine timing adjustment by incrementally scanning a relatively narrow modulator activation signal over a timing interval centered about the coarse timing value determined in to establish a fine timing value that corresponds to a change in an amount of non-quantum signals detected due to a change in modulation of the non-quantum signal."
However, Bennett in an analogous art discloses a non-orthogonal quantum key distribution method where the sender generates random bit sequence/time X and launches corresponding modulated signals R (t) and S (t) into the two subchannels where the modulation scheme will allow the sender and receiver to test/scan for eavesdropping (EVE) and that the quantum channel transmissions corresponding to different X sequences should represent non-orthogonal quantum states *(Bennett [Col.3/ lines19-35]).*

. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Zavriyev's two-way Quantum Key Distribution system and active compensation with a non-orthogonal quantum key distribution method where the sender generates random bit sequence/time X and launches corresponding modulated signals R(t) and S(t) into the two subchannels where the modulation scheme will allow the sender and receiver to test/scan for eavesdropping(EVE) and that the quantum channel transmissions corresponding to different X sequences should represent non-orthogonal quantum states in order to provide additional security as suggested by Bennett *(Bennett[Col.3/ lines19-35]).*

Regarding **claim 10** in view of claim 9, the references combined disclose
"wherein the timing interval in c is the same as the width of the relatively wide
activation signal in b", *i.e. the width of a wavelength is measured in time such*
*that the length of the width of the wave corresponds directly to the timing*
*interval (wavelength is known to be relative to time delay).*


**Claims 11-13** are rejected under 35 U.S.C. 103(a) as being unpatentable
over NPL "Integrated quantum key distribution key system using single sideband
detection" by J-M Merolla, L. Duraffourg, J-P Goedgebuer, A. Soujaeff, F. Patois,
and W.T. Rhodes (hereafter referenced as Merolla), in view of Patent Number:
5,515,438 to Bennett et al (hereafter referenced as Bennett).

Regarding **claim 11,** Merolla discloses "In a quantum key distribution
(QKD) system having first and second optically linked QKD
stations"*(see[Fig.1/pg.142] first station "Alice" and second station "Bob")* ,
"a method of establishing timing of first and second modulator activation signals
VI and V2 and for a first modulator MB *(modulation signal for Bob is equal to*
*$MZ_2$ pg.142/section 2 Principle with respect to timing pulse equation*
*$P_2$[pg.143/ Equations(14)])* in the first QKD station Bob and a second modulator
MA in the second QKD station Alice"*(see timing pulse equation for Alice $P_1$*
*and $P_2(t)$ for Bob where  [pg.143/ equations(13,14)] ),* "respectively, the
method comprising: setting the second modulator MA to a fixed modulation"
*(second modulation signal Alice is equal to $MZ_1$ [pg.142/section 2 Principle]*
*);* "setting the first modulator MB to a fixed modulation" *(first modulation signal*

***MZ₂ also see modulation depth equation E₂(t)=1/2 E₁(t)[1-jexp{jm***

***cos(Ωt+Φ2+π/2)}] [pg.142]) where modulation depth is equal to m [pg.142]),***

; "varying the first activation signal timing in a coarse increment $\Delta T1$ about an

initial timing T10 to establish a course timing T1C of the first activation signal by

observing a change in detector counts of exchanged non- quantum pulses"

***(signal Alice is varied over time and observed via detector D1 [see Fig.1***

***which shows PLO1(Alice) with Detector(D1) [pg.142]);*** ; varying the first

activation signal timing by reduced timing intervals $\Delta TR<\Delta T1$ about the coarse

timing T1C to establish a fine timing T1F of the first activation signal by observing

a change in detector counts of exchanged non-quantum pulses" ***(signal Alice is***

***varied over time and observed via detector D1 [see Fig.1 which shows***

***PLO1(Alice) with Detector(D1) [pg.142]);*** varying the second activation signal

timing by coarse timing intervals $\Delta T2$ about an initial timing T20 to establish a

course timing T2C of the second activation signal by observing a change in

detector counts of exchanged non- quantum pulses" ***(signal Bob is varied over***

***time and observed via detector D1 [see Fig.1 which shows PLO1(Alice)***

***with Detector(D1) [pg.142]);*** varying the second activation signal timing in

reduced timing increments $\Delta T2R<\Delta T2$ about the course timing T2C to establish a

fine timing T2F of the second activation signal by observing a change in detector

counts of exchanged non-quantum pulses" ***(signal Bob is varied over time and***

***observed via detector D1 [see Fig.1 which shows PLO1(Alice) with***

***Detector(D1) [pg.142]);*** Merolla does not explicitly discloses "setting the first

activation signal V1 to a relatively large initial width W1C" ; "setting the first

activation signal to a reduced width W1R < W1C"; setting the second activation signal V2 to a relatively large initial width W2C; setting the second activation signal to reduced width W2R<W2C." However, Bennet in an analogous art discloses a Quantum key distribution system using non-orthogonal macroscopic signals where the signal intensity/width can be relatively large and at the receiving end can be reduced via a beam reducer **Bennet [Col.8/lines 46-58].**

Therefore , it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Merolla's Integrated quantum key distribution system using single sideband detection with a Quantum key distribution system using non-orthogonal macroscopic signals where the signal intensity/width  can be relatively large and at the receiving end can be reduced via a beam reducer in order to introduce the feature of signal intensity to provide additional security enhancement as suggested by Bennet **Bennet[Col.8/lines 46-58].**

Regarding **claim 12** in view of claim 11, the references combined disclose "including setting the first and second modulator activation signals to cause a maximum change in the detector count when a change in modulation occurs in the exchanged non-quantum pulses"**(modulation depth parameter is set within specific range to make signals imperfectly distinguishable Bennett[Col.5/lines 54-64]).**

Regarding **claim 13** in view of claim 11, the references combined disclose "wherein the QKD system is a two-way system with the first QKD as Bob"**(see Bob Zavriyev[Fig.1])** , "and further including: discerning between timing intervals

associated with pulses entering and leaving the first QKD station to ensure that only quantum pulses that are incoming to the first QKD station are modulated during operation of the QKD system when exchanging quantum pulses to establish a quantum key"*(Control signal is used to trigger the timing/sync scheme between QKD's Bob and Alice(Zavriyev[Col.7lines38-51])*.

## Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Young et al (Patent No.: US 7,450,718 B2) disclose a one-way synchronization of a two-way QKD system.

Phoenix et al (Patent Number: 5,764,765) disclose a method for key distribution using quantum cryptography

Mitchell et al (Patent No.: US 7,233,672 B2) discloses a constant modulation for enhancing QKD security.

Tanaka et al (Pub. No.: US 2007/0248362 A1) discloses optical communication device and quantum key distribution system using the same.

Vig et al (Pub. No.: US 2006/0018475 A1) disclose KD systems with robust timing

Zoller et al (Patent No.: US 7,317,574 B2) disclose long distance quantum communication.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL ANDERSON whose telephone

number is (571)270-5159. The examiner can normally be reached on Monday-Friday 8am til 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nasser Moazzami can be reached on (571)272-4195. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Carl Colin/                                        MICHAEL ANDERSON
Primary Examiner, Art Unit 2433                     Examiner, Art Unit 2433